September Presentation

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Friday 16^{th} September, 2016

Introduction

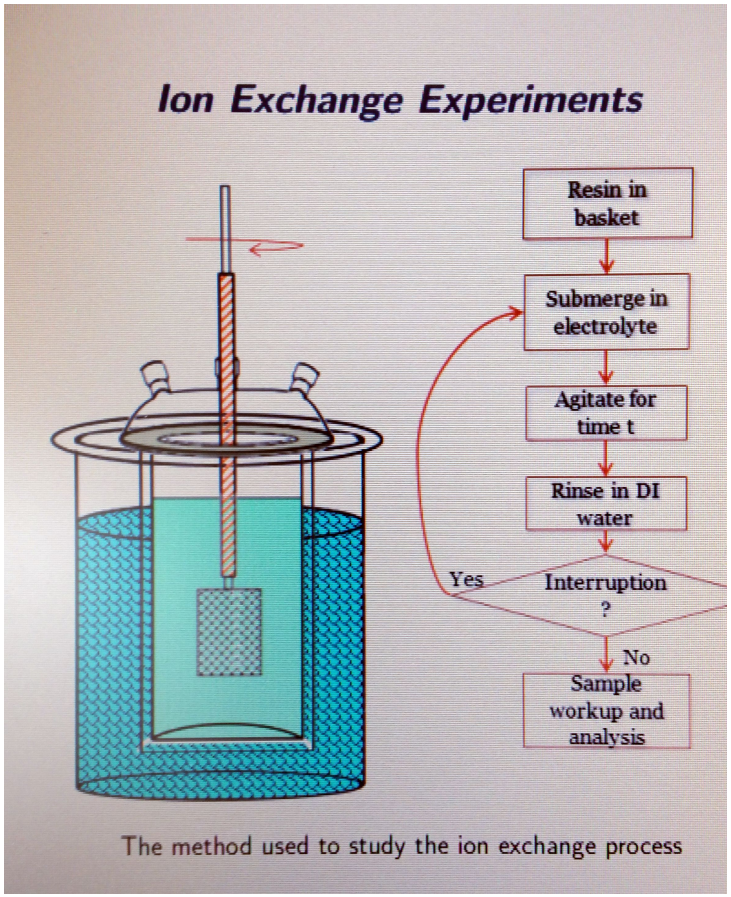
Last time we met the following objectives were stated:

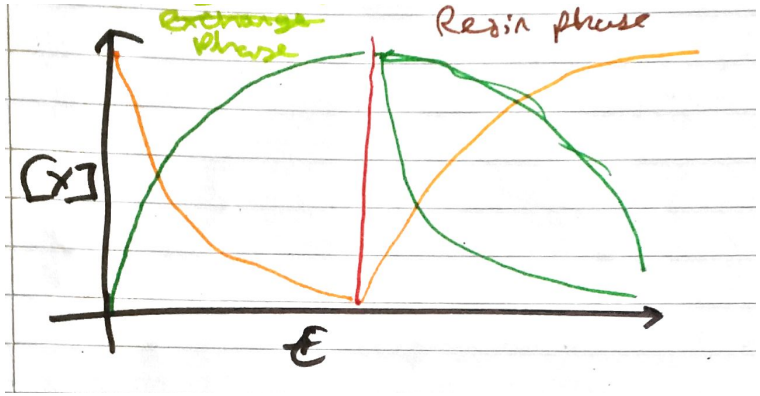
Goal	Status
Basic ion exchange experiments for complex quats	Achieved
Temperature vs diffusion coefficent studies	Achieved (mostly)
Polymer film studies	In progress
Provision of acrylamide beads to IP	In progress

- Ion exchange studies themseles are now essentially complete, tough NMR analysis has been delayed
- Polymr film studies are ongoing, and provision of acrylamide beads to IP will be done as soon as time permits

Recap: the ion exchange experiment

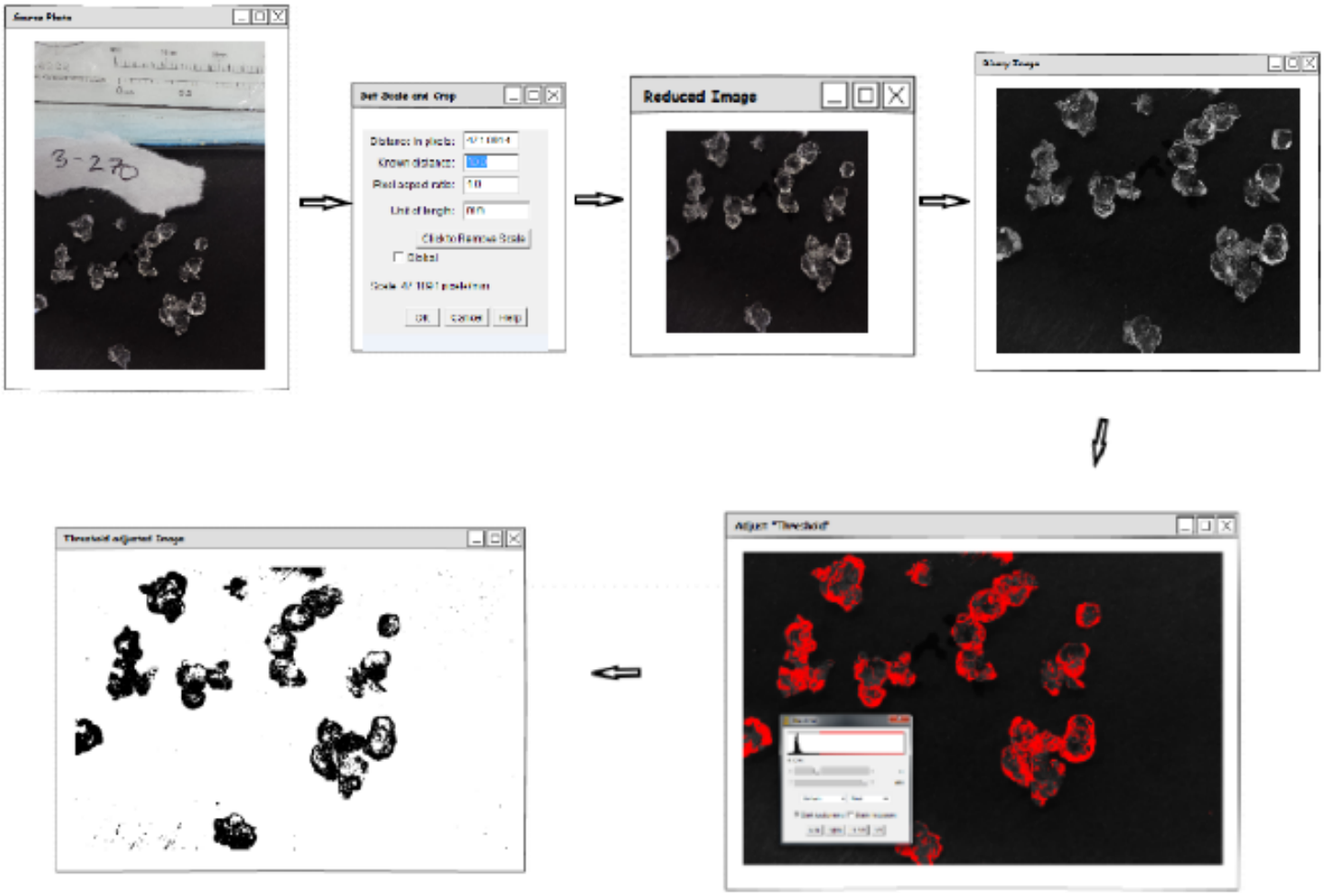
- The ion exchange experiment can be summarized as follows





0.2em 0.1ptWe opt to measure the contents of the ion exchange resinWe can measure the sodium ion content (flame photometry) or quaternary ammonium ion content (qNMR spectroscopy)

Particle size analysis

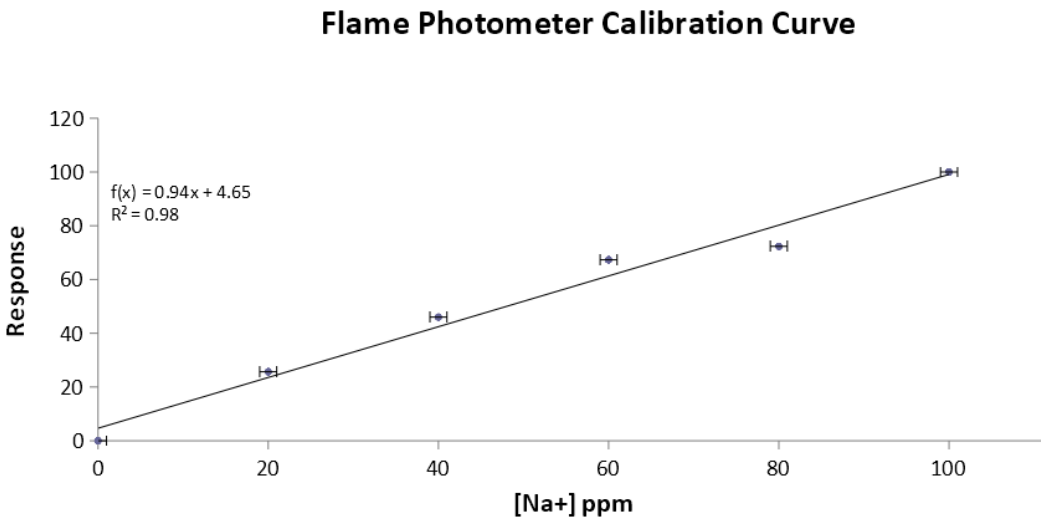


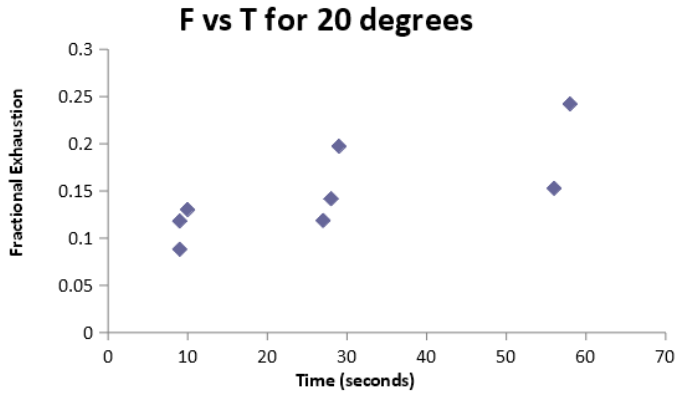
Model fitting

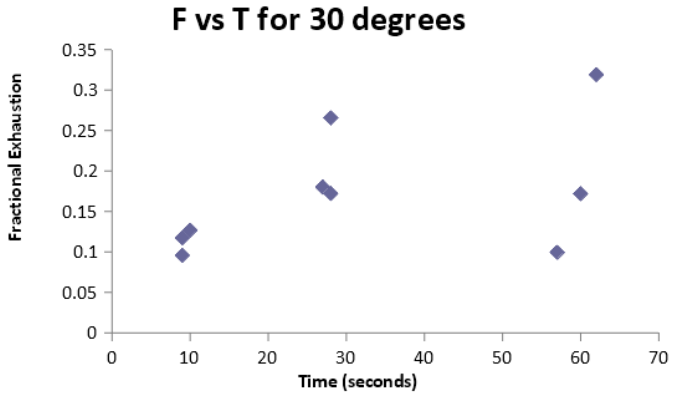
We now examine which model best fits the ion exchange data

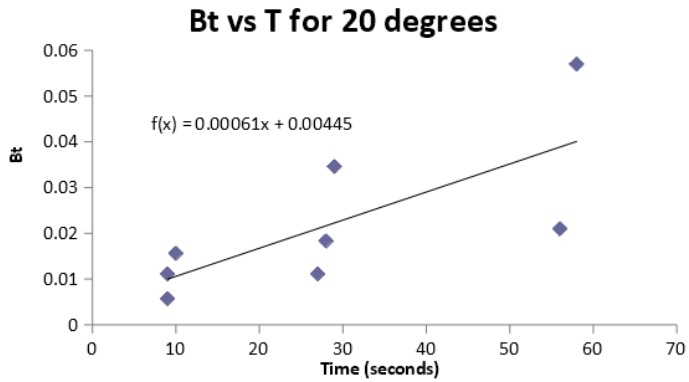
Model Author	Model expression
Boyd (Sphere)	$F = 1 - \frac{6}{\pi^2} \sum_1^\infty \frac{1}{n^2} e^{-D_i \pi^2 n^2 t r^{-2}}$
Boyd (Slab)	$F = 1 - \frac{8}{\pi^2} \sum_1^\infty \frac{1}{(2n-1)^2} e^{-(2n-1)^2 \pi^2 D_i t 4 r^{-2} 0}$
Diffusion in a bounding film	$log(1-F) = \frac{(\frac{3D_i}{r_0(\Delta r_0)\kappa})}{2.303} t$
Hellferich	$F(t) = \sqrt{1 - e^{\pi^2 f_1(\alpha) t + f_2(\alpha) t^2 + f_3(\alpha) t^3}}$

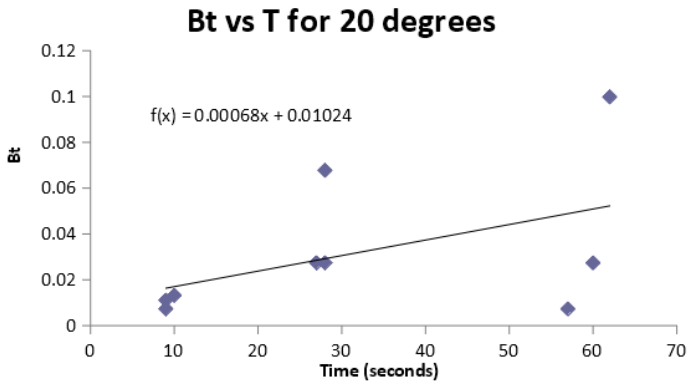
$RN\bar{M}R_4 + Na^+ \leftrightarrow R\bar{N}a + NMe_4^+$ exchange

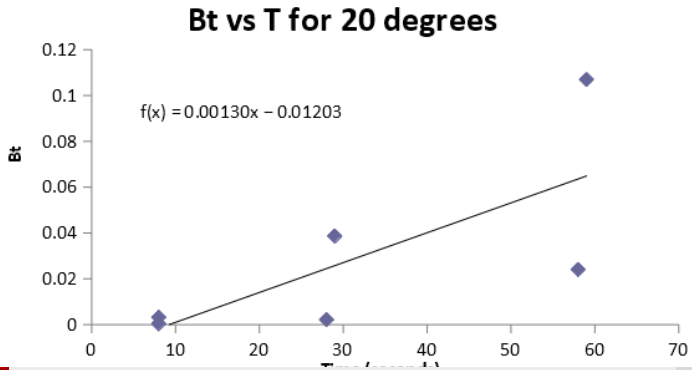







Bt vs T for 20 degrees
f(x) = 0.00061x + 0.00445
Bt
Time (seconds)
0.06
0.05
0.04
0.03
0.02
0.01
0
0
10
20
30
40
50
60
70


Bt vs T for 20 degrees
f(x) = 0.00068x + 0.01024
Bt
Time (seconds)
0.12
0.1
0.08
0.06
0.04
0.02
0
0
10
20
30
40
50
60
70


Bt vs T for 20 degrees
f(x) = 0.00130x − 0.01203
Bt
0.12
0.1
0.08
0.06
0.04
0.02
0
0
10
20
30
40
50
60
70